HEWLETT PACKARD INVENTION DISCLOSURE

PAGE ONE OF _____

PDNO: 10005744 DATE RCVD: ATTORNEY:

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Description Title of Invention:

Retractable Page Electronic Book

Name of Project:
Printer Consumables

Product Name or Number:

Memo:

Was a description of the invention published, or are you planning to publish? If so, the date(s) and publication(s):
No

Was a product including the invention announced, offered for sale, sold, or is such activity proposed? If so, the date(s) and location(s):
No

Was the invention disclosed to anyone outside of HP, or will such disclosure occur? If so, the date(s) and name(s):
No

If disclosure occurs 1 year or more before the filing of a patent application in the United States, you will not be able to get a patent.

Was the invention described in a lab book or other record? If so, please identify (lab book #, etc.)

Significantly described in Vincent (PL Notebook #2643, p.140 dated June 4, 1998 and Vincent notebook #2391, p. 92-93 dated April 8, 2000

Was the invention built or tested? If so, the date:

No

Was the invention made under a government contract? If so, the agency and contract number:

No

Description of Invention: *Please preserve all records of the invention and attach additional pages for the following. Each additional page should be signed and dated by the inventor(s) and witness(es).*

A. Prior solutions and their disadvantages (if available, attach copies of product literature, technical articles, patents, etc.).
B. Problems solved by the invention.
C. Advantages of the invention over what has been done before.
D. Description of the construction and operation of the invention (include appropriate schematic, block, & timing diagrams; drawings; sketches; graphs; flowcharts; computer listings; test results; etc.)

Prior Solutions:

Print is today mostly available through books, magazines, newspapers and various other forms of ink/toner on paper. The information content contained in this form is of a sufficiently high resolution and contrast to be easily read over prolonged periods of time without eye discomfort. Print media is also highly portable, allowing comfortable reading in locations of choice and body positions that may be periodically varied to change reading distance and posture to maintain comfort. Such print media, however, requires high cost in printing, binding, warehousing, and distribution. Given these factors require time expenditure to locate content (generation and availability to the reader, the content of the media is not contemporaneous. The cost is normally amortized through a single reading, after which the book or document is physically stored or discarded. Computers, on the other hand, provide virtually instantaneous distribution of content through the Internet at significantly reduced cost to the reader. Computer displays, however, provide far less comfortable reading of significantly lower resolution to print media. Cathode ray tube displays have low portability and require substantially stationary body positioning for reading at fixed focal length, leading to comparatively rapid eye and posture discomfort. Liquid crystal portable computer displays allow somewhat greater portability, but at the expense of display contrast, off axis viewability and cost. The order of magnitude lower resolution of computer displays in comparison to commercial print media commonly prevents the reader from seeing a full page comparable document at one time, in part, the lower resolution of portable displays stems from the difficulty of matrix addressing at higher resolutions. Normally, the reader must use button controls to scroll the displayed image down the document page to read its contents. When a long document is downloaded from the Internet, the reader will commonly print the contents to gain back the aforementioned

EXHIBIT NO. VINCENT 1

print media benefits. Such printing, however, adds local printing cost to the process for documents that are commonly read once and discarded. Current computing solutions are, thereby, contrary to the needs of book, magazine and newspaper distribution.

Problems Solved and Benefits

The present invention introduces a paradigm shift in the concept of reading media and media distribution. The invention introduces an electronic book comprising a spine and a single retractable, rewritable page. The contents of a page, pages, a book or books may be digitally downloaded into memory housed in the book spine via a computer link (e.g. a line connection or IR) or plug-in memory. Each document page is printed from memory through a high resolution electrode array print head as the page is pulled out of the spine. The page contains field writable and erasable, bi-stable colorant that forms the image. Once the page is read, the contents of a subsequent page may be printed by retracting the spring loaded page back into the spine and extracting it a second time, such that the page is erased and reprinted with the new image. This motion is much like the motion of turning a standard book page. Buttons on the spine allow forward and backward movement through the document, skipping to adjacent chapters and moving from one document to another. Once a reading session is completed, the sheet is retracted into the spine to provide compact storage of the book. It thereby requires less storage space than the book(s) it replaces. The last read page is electronically bookmarked allowing the reader to automatically access the same page when a subsequent reading session begins.

The present invention provides the high resolution, contrast, portability and compactness of commercial print media, at the distribution speed and cost advantage of internet distributed media. Using these benefits, books, magazines and journals may be purchased on-line and downloaded via the internet, replacing the necessity of purchasing the hardcopy version. The electronic book may be used in place of standard computer displays for most on-line reading. It provides superior pixel resolution with far simpler pixel addressing than common to flat panel displays. The bi-stable, rewritable colorants are also highly energy efficient, requiring energy only to change an image, not to hold it or illuminate it. This is in stark contrast to all computer displays and offers the potential of battery operated full portability. Unlike commercial flat panel displays, the present rewritable page contains a colored film analogous to printed ink films and is thereby readable at all viewing angles.

The electronic book of this invention is ideally suited for e-commerce subscription with copyright security. Internet document providers may download documents to a subscriber via the internet following a handshake between the connected electronic book and document server. Through the handshake, the book serial number or other security code sequence is passed to the server to assure that the document will be transferred only to the memory of the electronic book. In this instance, the electronic book is a read-only device incapable of passing the copyrighted document contents to other electronic devices. Since the majority of consumer book cost covers the cost of printing, binding, distributing and retail, e-commerce subscription also offer a significant cost savings to the customer while the content provider can receive even greater royalty for the content than through book publication.

Construction

The electronic book of the present invention comprises a rewritable sheet, an electrode array printer, a media translation sensor, a spring loaded sheet pay-out cylinder and associated circuitry to download, store, sequence and print images. Each of these is housed in a "book" spine from which the rewritable sheet may be manually extracted for reading and retracted for storage or image change.

The rewritable sheet consists of a flexible substrate that has a coating thereon containing electric field switchable colorant. The color or transparency of the colorant changes with field polarity applied across the colorant and remains chromatically stable in the absence of a field. HPL is currently developing bi-stable molecular switches that are ideally suited for the present colorant. The color, as well as the electrical conductivity of a molecule is determined by the level of its pi and D orbital electron conjugation. By disrupting the continuity of conjugation across a molecule, the molecule may be changed from conductive to non-conductive, colored to transparent or from one color to another. Charge dipoles designed into the colorant can physically cause this disruption by field rotating or otherwise distorting certain segments of the dye molecule relative to other segments. For the present invention, the colorant is preferably black in its conjugated orientation and transparent in its field conjugated orientation. By making the substrate white, the rewritable sheet may thereby produce high contrast black and white images. The colorant may comprise a single field switchable black dye or multiple colored dyes that collectively produce a composite black. By using molecular colorant, the resolution of the produced image is limited only by the electric field resolution produced by the electrode array print head. Molecular colorant additionally has virtually instantaneous switching speed, beneficial to the needs of fast pagination. Other electrochromic colorants, such as the dichromal "Gyricon" sphere (Xerox) and microencapsulated electrophoretic dye (E Ink), are also applicable to this invention. In each case, the colorant is preferably contained in a polymeric layer that may be optionally overcoated with a transparent protective or gloss control coating layer. Polymers for producing such coatings are well known.

The electrode array printer of the present invention comprises a sheet-wide linear array or equivalent staggered array of electrodes in contact or near contact with the rewritable sheet surface. A set of rollers may be used to maintain the desired spacing of sheet and array. Each electrode is sized, positioned and electrically addressed to provide an appropriate electric field across the colorant at a given pixel location along a pixel column of the rewritable sheet. The field may be oriented perpendicular to the plane of the sheet or parallel to it. In the former case, a common electrode is placed on the opposing side of the sheet from the array. In the latter case, a common electrode or electrodes is placed adjacent and parallel to the array so that printing is accomplished by passage of fringe fields through the colorant. Fringe field imaging is advantageous since the electric field

is not significantly influenced by the physical structure of the substrate. When the field is electrostatic, going through the thickness of the rewritable sheet, it is highly desirable that the substrate be conductive or of high dielectric constant to minimize voltage drop across the sheet and to prevent loss in field resolution due to field broadening. Electrode arrays and drive electronics are common to electrostatic printers and their constructions and interfaces are well known. Positive and negative fields may be produced without requiring drivers to produce positive and negative voltages. This can be accomplished by holding the common electrode at an intermediate voltage level and cycling the array electrodes between a high and low voltage (e.g. ground).

The media translation sensor is used to sense the index-to-pixel row location of the sheet relative to the electrode array to time printing pulses. This allows the user to extract the sheet at virtually any speed. The sensor may also be used to detect the start and end positions of sheet travel. A number of different sensing schemes are applicable, including a shaft encoder attached to the axis of a roller engaged with the sheet, a sheet texture sensor (e.g. MR Magnetic) or linear encoder positioned to read a coding track along the sheet. The rewritable sheet is imaged by printing a column of pixels one row at a time as the sheet is passed by the electrode array.

One end of the rewritable sheet is attached to a spring loaded payout cylinder. The spring mechanism of the cylinder is similar, if not identical, to a common window shade cylinder. When the electronic book is not in use, the sheet is retracted by spring force to wrap around the cylinder. As the sheet is extracted, the spring coils. As with the window shade mechanism, the cylinder may optionally contain a ratchet or detent mechanism that holds the sheet in its extended "read" position. To retract the sheet, the user simply pulls the sheet to release the hold. Preferably, the unattached end of the sheet has a small attached stop (e.g. bar or rod) that prevents the sheet from retracting into the spine beyond an easily accessed pull point. The payout cylinder may optionally contain or be axially attached to a small electric generator that produces regenerative current for batteries or that provides or complements the energy required to print the sheet as it is pulled out of the spine.

The rewritable sheet may optionally contain a mosaic pixel pattern of different colorants (e.g. cyan, magenta, yellow, black). Such a pattern may be initially imaged through conventional printing means, for example, ink jet or lithography. The patterned colorants may optionally be printed with a fiducial mark to allow optical sensing of the colorant positions during electronic imaging. The pattern of colorants may be addressed by the electrode array to produce color images.

The data input, storage, sequencing and utility electronics for the electronic book are contained in computer related electronics. Data may be input using standard ROM or RAM cards (e.g. multi megabyte PC Cards or equivalent format disk drives) that contain the preloaded contents of a book, library of books, magazine or other document or documents. The data may optionally be downloaded into on-board memory via cable or IR connection from a computer or computer peripheral device. Such downloading may be done by first paying a security code from the electronic book to the document provider server to ensure the safety of copyrighted material. The electronic book preferably contains a standardized formatting algorithm to allow fast data transfer into memory with low document memory requirement. When multiple documents are stored in memory, the user may print a Documents page and select from the list the document of choice by entering or toggling a number through a button or buttons located along the spine of the book. Preferably, the book has a small, low power (e.g. liquid crystal) display to assist in the selection. Following selection of a particular document, the user may print a contents or index page for the document to input the starting page for reading. Once printed, the page succeeding electronically sequentially registers to the next page whenever the sheet is retracted and extracted. This sequence may be overridden through key input along the spine of the electronic book. Separate buttons for CONTENTS, PAGE FORWARD and BACKWARD assist in the process. Bookmark pages are automatically stored in memory for each stored document so a reader may return automatically to the last read page when re-selecting a document.

Signature of Inventor(s): Pursuant to my (our) employment agreement, I (we) submit this disclosure on this date: [ ].

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If more than four inventors, include additional information on another copy of this form and attach to this disclosure.

Signature of Witness(es): [illegible]

The invention was first explained to, and understood by, me (us) on this date: [ ]

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Retractable Page Electronic Book